

Assessing the Scalability of the Pay-As-You-Go Model in Refugee Settlements

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Executive Summary

Using data from Mercy Corp's Access to Modern Energy in Humanitarian Settings (AMPERE) pilot project, we assessed whether the PAYGO solar model is a viable way to provide clean energy options in humanitarian settings, specifically focusing on the Bidibidi refugee settlement in Northern Uganda. Our research confirmed that while there is a demand for solar products in Bidibidi, the subsidy was more effective at increasing access than PAYGO. This could either be explained by the fact that only 4 out of 8 products were offered as PAYGO or by the fact that monthly payments for PAYGO are too high for most of the participants. Additionally, as women make up 53 percent of the population in the camp and have low mobile access PAYGO does not solve their energy and financing needs. Both the refugees and the PAYGO providers stated that they cannot participate in the program if it were not for the subsidy provided by Mercy Corps. This led to the conclusion that scaling up PAYGO programs in refugee settlements will require major adjustments to the original model. Our study concludes by recommending that a program that builds a partnership with UNHCR or another governmental agency in order to sustain the subsidy would be better suited for the market expansion and increasing accessibility. Furthermore, another model that could be a good fit for Bidibidi would be one that combines mini or micro grids subscription model with financing accessible through village savings and loans associations (VSLAs) that are primarily targeted towards women.

Introduction

Pay-As-You-GO (PAYGO)

Uganda possesses a successful PAYGO solar energy market environment. However, the presence of PAYGO companies in Uganda's West Nile region is limited. Many refugee settlements including Bidibidi, are located within the West Nile region.¹ Initial research from

¹ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019. , www.mercycorps.org/sites/default/files/2020-01/Paying_for_Darkness_Uganda_FINAL.pdf

Mercy Corps into why PAYGO is absent in refugee settlement markets and how introducing off-grid solar (OGS) to increase energy access options for refugees has revealed several market constraints. The first constraint was product appropriateness and availability. Previous PAYGO energy products from companies did not align with refugee community budgets and timelines for repayment.² Further complicating this was the low awareness and availability of low-priced OGS products. The second constraint was misaligned demand perception. PAYGO providers did not send sales representatives into the Bidibidi settlement to gauge community purchasing power. They were primarily worried about the financial risk of lending to refugees.³ The third constraint was market linkages and infrastructure. Because the potential client communities within the settlements were dispersed and often hard to reach, OGS companies would charge high prices for services.⁴ The fourth constraint was appropriate finances. While residents of refugee settlements expressed ability and interest in purchasing the lowest tier of PAYGO deposits and smallest OGS products, this still required them to save on average three months to prepare funds.⁵

These market constraints have stimulated a last mile PAYGO low-tiered OGS market to provide refugee settlements with quality, affordable, and diverse options for energy. Particularly, using a market-based approach where humanitarian organizations are working with local supplies to purchase products, and identifying market constraints, and strategizing about scalability prove more impactful than simply delivering products or providing in-kind distributing.⁶ The PAYGO companies can now directly sell their products to refugees on a credit system. This reduces affordability barriers to energy access for those who cannot pay the upfront costs or prefer to split payments over longer periods.⁷

EmPower Bidibidi Project Goals

Objectives

The EmPower Bidibidi practicum project intends to provide an objective and detailed assessment of Mercy Corp's AMPERE pilot project and its effectiveness in providing a sustainable source of clean energy access to the Bidibidi refugee settlement located in Northern Uganda. Our objectives are twofold:

- 1) Provide insights into whether the PAYGO model addressed the specific energy-related concerns of different demographic groups in the settlement, particularly women.
- 2) Provide scalable best practices for the PAYGO model that can then be leveraged as solutions for refugee settlements around the world.

More information on the methodology of the report can be found in Appendix 1.

² PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019.

³ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019.

⁴ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019.

⁵ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019.

⁶ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019, www.mercycorps.org/sites/default/files/2020-01/Paying_for_Darkness_Uganda_FINAL.pdf

⁷ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019, www.mercycorps.org/sites/default/files/2020-01/Paying_for_Darkness_Uganda_FINAL.pdf

Refugee Rights and Humanitarian Settlements in Uganda

Uganda's Refugee Framework

Uganda is home to roughly 1.4 million refugees primarily from South Sudan, the Democratic Republic of Congo (DRC), and Burundi.⁸ Uganda's refugee policy is often regarded as one of the most progressive in the world.⁹ The official refugee policies date back to the 1955 Control of Refugees from the Sudan Ordinance and was replaced with the restrictive Control of Alien Refugees Act (CARA) in 1960.¹⁰ Similar to contemporaneous refugee policies, CARA granted sweeping discretionary power to legal authorities and confined refugee populations to settlements. However, the large influx of refugee movement both into and out of Uganda over the next few decades spurred political instability, regional regime change, and stoked conflict.¹¹

While the legal framework for refugees was modified slightly, its biggest adjustment came in 1999 with the Self-Reliance Model, implemented jointly by the government and the UNHCR, which was ostensibly meant to transform the refugee model into one that promoted self-sufficiency.¹² Uganda's commitment to providing refugees with freedom of movement and their own plots of land for subsistence farming date back to its first refugee settlement, Nakivale, in 1958.¹³ These policies were formalized with donor support in 1999 as part of the Self-Reliance Strategy.¹⁴ This was followed by the 2006 Refugee Act and the Refugee Regulations of 2010, which ensured the right to work, freedom of movement within the country, and right to formally register new businesses.¹⁵ Additionally, unlike the policies developed in surrounding countries, Uganda ensures that refugees are included in the nation's social services programs.¹⁶ The right to work and freedom of movement afforded to refugees in Uganda appears to be correlated with increased mobility, greater incomes, and more reliable sources of income.

Bidibidi Refugee Settlement

Bidibidi has over 270,000 residents and is considered the largest refugee settlement in Uganda and the second-largest refugee settlement in the world behind the Rohingya settlement in Bangladesh.¹⁷ The settlement is located in the Yumbe district in the northwestern corner of Uganda and the vast majority of its residents fled South Sudan.

Residents of the Bidibidi settlement speak a variety of languages. The most recent statistics from the settlement suggest that the majority of the refugees speak Kakwa and different Bari languages,¹⁸ while the residents of the Yumbe district mostly speak Aringa.¹⁹

⁸ "Uganda- Refugee Statistics January 2020," (UNHCR and Uganda OPM, January 2020), <https://reliefweb.int/sites/reliefweb.int/files/resources/73914.pdf>; Betts, A., et al. Refugee Economies in Uganda: What Difference Does the Self-Reliance Model Make? Refugee Studies Centre, 2019.

⁹ "Uganda- Refugee Statistics January 2020," (UNHCR and Uganda OPM, January 2020), <https://reliefweb.int/sites/reliefweb.int/files/resources/73914.pdf>; Betts, A., et al. Refugee Economies in Uganda: What Difference Does the Self-Reliance Model Make? Refugee Studies Centre, 2019.

¹⁰ Havil, Lucy. Uganda's refugee policies: The history, the politics, the way forward. PDF file. October, 2018. <https://reliefweb.int/sites/reliefweb.int/files/resources/IRRI-Uganda-policy-paper-October-2018-Paper.pdf>

¹¹ Havil, Lucy. Uganda's refugee policies: The history, the politics, the way forward. PDF file. October, 2018. <https://reliefweb.int/sites/reliefweb.int/files/resources/IRRI-Uganda-policy-paper-October-2018-Paper.pdf>

¹² Havil, Lucy. Uganda's refugee policies: The history, the politics, the way forward. PDF file. October, 2018. <https://reliefweb.int/sites/reliefweb.int/files/resources/IRRI-Uganda-policy-paper-October-2018-Paper.pdf>

¹³ Betts, A., et al. Refugee Economies in Uganda: What Difference Does the Self-Reliance Model Make? Refugee Studies Centre, 2019.

¹⁴ Havil, Lucy. Uganda's refugee policies: The history, the politics, the way forward. PDF file. October, 2018. <https://reliefweb.int/sites/reliefweb.int/files/resources/IRRI-Uganda-policy-paper-October-2018-Paper.pdf>.

¹⁵ Betts, A., et al. Refugee Economies in Uganda: What Difference Does the Self-Reliance Model Make? Refugee Studies Centre, 2019.

¹⁶ Betts, A., et al. Refugee Economies in Uganda: What Difference Does the Self-Reliance Model Make? Refugee Studies Centre, 2019.

¹⁷ Uganda- Refugee Statistics May 2019- Bidibidi," (UNHCR and Uganda OPM, May 2019), <https://reliefweb.int/sites/reliefweb.int/files/resources/70050.pdf>; "Uganda- Refugee Statistics January 2020," (UNHCR and Uganda OPM, January 2020), <https://reliefweb.int/sites/reliefweb.int/files/resources/73914.pdf>; Strochlic, Nina, and Nora Lorek. "A City Rises." National Geographic Magazine, Apr. 2019, p. [105]+. National Geographic Virtual Library, <http://tinyurl.com/tinyurl/CbINE5>. Accessed 20 Jan. 2020.

¹⁸ Uganda - Refugee Statistics October 2019 - Bidibidi. UNHCR, 1 Nov. 2019, data2.unhcr.org/en/documents/download/72277.

¹⁹ Boswell, Allan. Contested Refuge: The Political Economy and Conflict Dynamics in Uganda's Bidibidi Refugee Settlement, European Union, 2018, data2.unhcr.org/en/documents/download/66344.

According to the most recent UNHCR reports, the Bidibidi settlement is made up almost entirely of South Sudanese refugees, with the largest group identifying as Kakwa.²⁰ Women and children make up 87% of the settlement's population, and the majority of households in the settlement are headed by women. The settlement has 26.6% employment, and farmers make up the largest category of employment.²¹

Overview of PAYGO Solar Financing Model

The pay-as-you-go (PAYGO, sometimes stylized as PAYG or PAY-Go) business model has emerged as a mechanism to reduce upfront cost for consumers, while maintaining minimal risk to solar manufacturers and distributors. This model aims to improve the financial accessibility of off-grid solar home systems.

Over the past decade, the PAYGO sector has expanded rapidly; in the first half of 2019 PAYGO sales surpassed one million lighting units for the first time.²² Inspired by the model popularized by mobile phones, the PAYGO model is simple: a household makes a down payment for a solar home system, and then pays off the remaining balance of the system cost in installments of regular amounts over regular intervals. The installment payment amount and interval outlined vary by company, and are in the PAYGO contract, while the solar home system serves as the sole collateral. Researchers have found that “being able to pay overtime... brought an otherwise expensive asset within reach for a much larger number of families. Many respondents reported that they would not have been able to buy the [solar home system] if they had to pay in full at once,” and that if the solar home system were a “lumpy” payment, it would be competing for other high priced commodities such as furniture or land purchases.²³ The PAYGO model already reflects a payment system familiar with the target market populations, while reducing high costs often associated with new solar home systems.

The PAYGO model also allows companies a high degree of flexibility to meet customers' needs. Product size and price, upfront payment amount, pay-back period, installment amounts, payment method, and consequences of non-payment are highly variable between companies. The flexibility of the PAYGO business model allows it to be adaptable to a wide-range of contexts, and provides consumers the opportunity to choose the company that matches their needs and available resources.

Critiques of the PAYGO Model

While PAYGO offers the opportunity for sustainable energy access growth in low-income and impoverished communities, some research has led to critiques about the business model. In particular, about PAYGO's affordability, access, social consequences, and ability to address the full scope of its customers' energy needs. These may be particularly true in high-risk communities, such as those humanitarian crisis settings.

²⁰ Uganda - Refugee Statistics April 2019 - Bidibidi. UNHCR, 1 Nov. 2019, <https://reliefweb.int/sites/reliefweb.int/files/resources/69442.pdf>

²¹ Uganda - Refugee Statistics October 2019 - Bidibidi. UNHCR, 1 Nov. 2019, data2.unhcr.org/en/documents/download/72277.

²² Global Off-Grid Lighting Association (GOGLA). *H1 2019 Global Off-Grid Solar Market Report*. October, 2019. Accessed from: <https://www.lightingglobal.org/resource/h1-2019-global-off-grid-solar-market-report/>

²³ CGAP. *Escaping Darkness: Understanding Consumer Value in PAYGo Solar*. December, 2017. Accessed from: <https://www.cgap.org/sites/default/files/researches/documents/Forum-Escaping-Darkness-Dec-2017.pdf>. Page 1.

The variability of the PAYGO model across companies is one of the model's strengths, however an initial deposit larger than the monthly installment payments is a common (though not universal) contract condition. This initial sum may sometimes be prohibitive, and some PAYGO customers surveyed describe requiring time to make the initial payment.²⁴ The ongoing payment plan may be a deterrent for customers with low or volatile income.²⁵ Research may indicate that these financial barriers may perpetuate existing fiscal disparities among impoverished communities. In a survey of Rwandan households that purchased the Indigo Duo solar lighting system from Azuri, it was found that the majority were those who "have a job and farmers who go beyond subsistence farming to produce a surplus which can be sold."²⁶ The survey concluded that "Indigo users are not from the poorest sections of the population..." and that "39.1% of Rwandan households, which are living under the poverty line, are unlikely to be able to afford Indigo."²⁷

Mobile money payments are a defining feature of most PAYGO company models. This allows companies to reduce costs associated with collection agents, while providing customers some flexibility with payment timing, including allowing them to make advance payments when possible. However, for a market to be attractive for PAYGO companies relying on mobile payments, there must be high levels of mobile phone accessibility. However, as of 2018, women in Bidibidi were more than 20% less likely to own a cellphone than their male counterparts were, and only 4% of women had mobile phones with internet access.²⁸ The PAYGO model's reliance on mobile payments may exacerbate gender inequity for energy access.

There may be social consequences for PAYGO solar customers. For PAYGO companies, the solar home system typically serves as the only collateral. To ensure payment, many installed systems are equipped with remote lockout mechanisms. These remote lockout mechanisms allow the PAYGO company to disable the solar home systems when a customer fails to make installation payments by agreed upon dates. While the remote lockout technology may be necessary to secure timely payments, there can be unintended consequences. Remote lockout may also be a sign to neighbors of the customer's poor financial condition, and harm the customer's social standing in the community.

Women in PAYGO Solar

While renewable energy and PAYGO solar represent opportunities to advance gender equality, there remains a litany of research questions that must be explored before any conclusions can be drawn. Additionally, there is a shortage of data regarding women's involvement in the Ugandan renewables sector as a whole and within PAYGO companies. An interview conducted by the Empower Bidibidi practicum team with Village Power, one of the local PAYGO service providers and participants in Mercy Corp's AMPERE pilot, revealed that only 2 members of their team of 9 in Bidibidi were female. Further research must be done to better understand how women are involved with the sector through formal employment.²⁹

²⁴ CGAP. *Escaping Darkness*. January 2018. Accessed from: <https://www.cgap.org/sites/default/files/researches/documents/Forum-Escaping-Darkness-Dec-2017.pdf>, pg 13.

²⁵ CGAP. *Escaping Darkness*. January 2018. Accessed from: <https://www.cgap.org/sites/default/files/researches/documents/Forum-Escaping-Darkness-Dec-2017.pdf>, pg 13.

²⁶ Collins, Simon and Anicet Munyehirwe. "Pay-As-You-Go Solar PV In Rwanda: Evidence of benefits to users and issues of affordability" *Field Actions Science Reports*. 2016. Accessed from: <https://www.energy4impact.org/file/1783/download?token=TA1nhUI9> pg 102.

²⁷ Collins, Simon and Anicet Munyehirwe. "Pay-As-You-Go Solar PV In Rwanda: Evidence of benefits to users and issues of affordability" *Field Actions Science Reports*. 2016. Accessed from: <https://www.energy4impact.org/file/1783/download?token=TA1nhUI9> pg 102.

²⁸ GSM Association. *Bridging the mobile gender gap for refugees*. March 2019. Accessed from: <https://reliefweb.int/sites/reliefweb.int/files/resources/m4hgendergaprefugeecontexts.pdf>

²⁹ Okello, Allan. Personal Interview. 11 Feb 2020.

In addition to research regarding women's involvement in PAYGO solar energy companies, more research needs to be completed to understand how PAYGO products are responding to women's needs and interests. Studies conducted within refugee populations in neighboring Kenya show that PAYGO solar purchasing decisions are primarily made by men (often overriding their wives' protests). Purchasers often cut their wives' budgets in order to afford the monthly payments.³⁰ A possible barrier to women's engagement with PAYGO products is the lack of mobile phone ownership and usage among women in refugee settlements. Data from 2018 indicates that women in Bidibidi were 23% less likely than their male counterparts to have used a cell phone in the prior 3 months, and there is a 30% gap in their cell phone ownership.³¹

Description of AMPERE Pilot

Initial Assessment by Mercy Corps and Mastercard Center

Mercy Corps partnered with the Mastercard Center for Inclusive Growth to conduct an initial assessment of the state of solar markets for refugees and host community members in Uganda. The research specifically focused on the energy needs and energy capacity of low-income and sparsely distributed refugees and host community populations in Uganda's West Nile region. The study also assessed the potential for PAYGO solar to increase the energy accessibility for the populations being observed.

The study came to the conclusion that PAYGO solar can be an excellent opportunity to cultivate an off-grid solar market in Uganda's West Nile region. However, PAYGO operations in refugee settlements will require different strategies from the current model used across urban emerging markets in Africa.³²

Pilot Design

Mercy Corps' goal for the AMPERE pilot was to test how market systems can be strengthened to bring quality energy and financial services to the Bidibidi refugee settlement in Northern Uganda. Mercy Corps partnered with two private solar energy providers—Village Power and d.light—to initiate the AMPERE pilot project. Mercy Corps played the coordinating role of the pilot. Village Power and d.light were tasked with managing all sales operations in the settlement. A total of 306 individuals from the Bidibidi Refugee settlement participated in the AMPERE pilot. The pilot commenced in November 2019 and concluded in March 2020.

³⁰ Zollmann, J., et al. "Escaping Darkness Understanding Consumer Value in PAYGo Solar." To connect with the Lighting Global team email: info@lightingglobal.org www.lightingglobal.org (2017).

³¹ Bridging the Mobile Gender Gap for Refugees . GSM Association, Mar. 2019, www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/04/M4H_GenderGapRefugeeContexts.pdf.

³²PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps. , Nov. 2019, www.mercycorps.org/sites/default/files/2020-01/Paying_for_Darkness_Uganda_FINAL.pdf; Johnson, Oliver W., Vanessa Gerber, and Cassilde Muhoza. "Gender, culture and energy transitions in rural Africa." *Energy Research & Social Science* 49 (2019): 169-179.

EmPower Bidibidi's Assessment of AMPERE

Overview

This field research study uses a mixed methods approach, which includes key informant interviews with implementation partners, renewable energy companies, governmental agencies, and focus group discussions and interviews with PAYGO subscribers and non-subscribers. Survey tools were carefully designed to gather both qualitative and quantitative data points where needed. The table in Appendix 2 summarizes the research questions the project is focused on, and where data was collected to evaluate and answer each question. A stakeholder mapping exercise (Appendix 3) was conducted to customize the survey instruments for each member and research question.

Synopsis of survey participants

The survey administered by Mercy Corps in Bidibidi included:

- 184 participants; 107 out of 184 were female and 88 out of 184 were refugees, with the rest from the host community (Yumbe region);
- 57 out of the total identified themselves as farmers and 37 identified themselves as aid dependent; this was a multiple-choice question, so there were participants who chose more than one option, however, farmers were the one group with high representation;
- Average household size was approximately 7 members;
- The average age of the participants was approximately 37 years old.

Data Analysis: Sustainability and Scalability

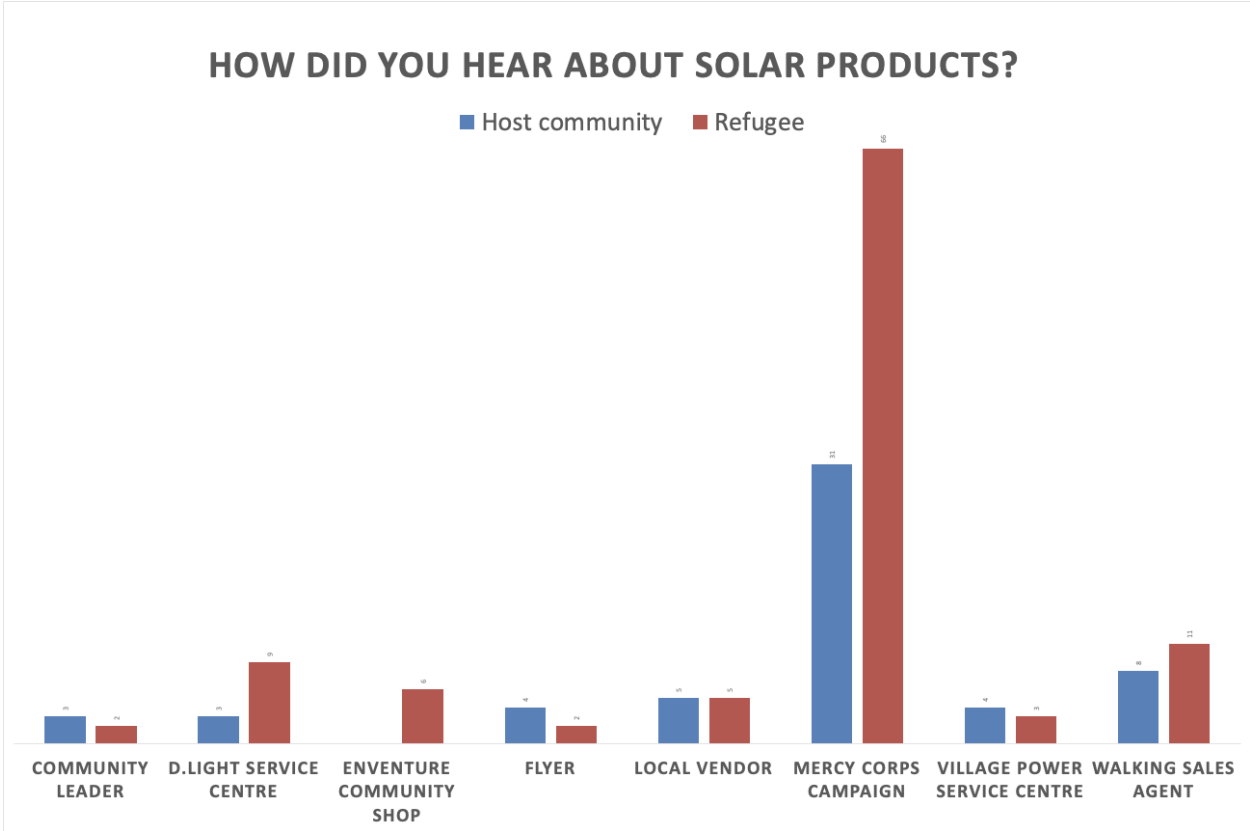


Chart 1: Marketing Activation Effectiveness

Chart 1: One of the primary purposes of the pilot was to activate the market in Bidibidi and test the viability of PAYGO resettlement settings, so the data was analyzed to uncover whether PAYGO was successful at making solar products affordable and accessible. Firstly, the results from the survey showcase that the market activation efforts implemented by Mercy Corps were successful because 60% of the participants shared that they learned about solar products through the “Mercy Corps campaign”, with 68% of those being refugees and 32% host community members. The second option with the highest overall results is “walking sales agent” at 12 %.

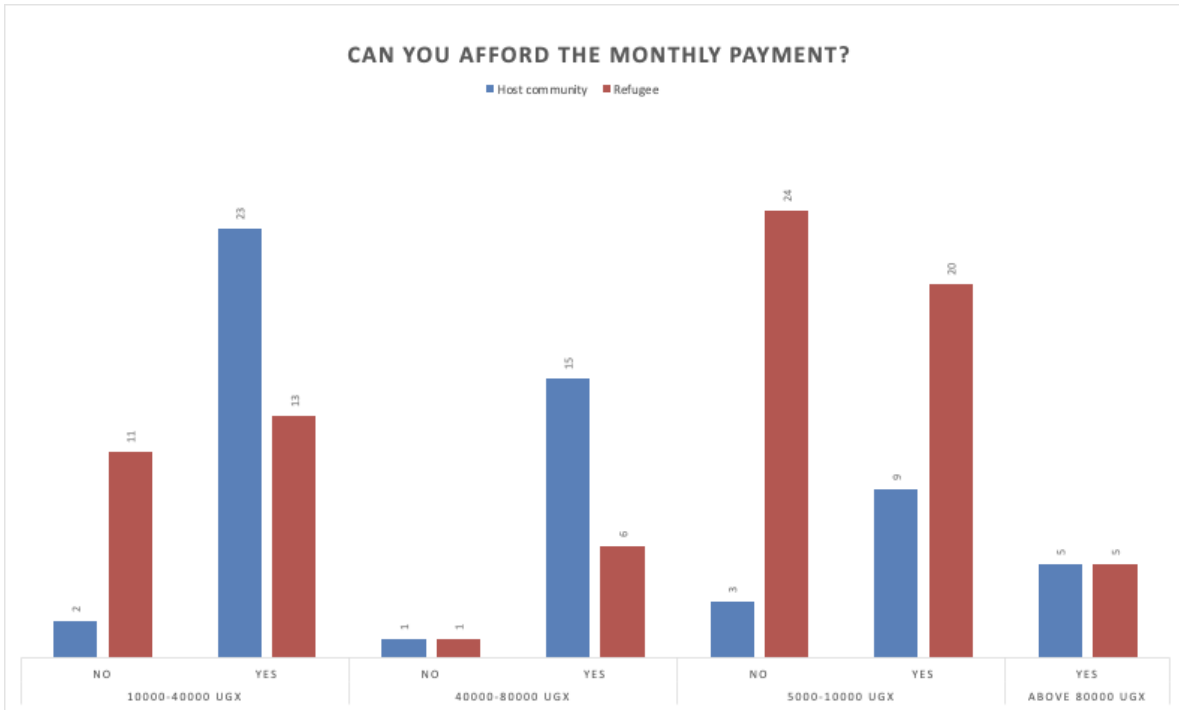


Chart 2: Monthly Payments for PAYGO

Chart 2: Evaluating affordability from the lens of monthly payments, 70% of the respondents said that they could afford their payments, however, 85 % of the ones who could not afford the monthly payments were refugees. To further evaluate affordability, the average household data was utilized to find a positive correlation between affordability and income. Within each income bracket, there are more refugees who conveyed difficulty in affording monthly payments than host community participants. For example, in the income bracket of 10,000 to 40,000 Ugandan Shillings (approximately \$2.63 to \$10.53 USD) there are 24 refugee participants who have an inability to afford monthly payments, as compared to 3 host participants. An important stipulation to consider here is that monthly payments are only applicable to subscribers of PAYGO solar products. This specific question on the survey had 138 responses, which included 81 respondents who said that they paid cash in full for their solar product. So, there is a major discrepancy in the data collected for this question, which could not be deciphered by our team, therefore, the analysis should be considered limited.

Data Analysis: Gender Access

For the research objective of evaluating effectiveness of increasing energy access for women, the descriptive analytics are summarized below:

- 56% of the 75 respondents who own solar lamps were female. 34 of those respondents paid cash in full and 8 used PAYGO.
- Firewood and torches are still a popular option for females.
 - 60.9% of 69 respondents being female reporting firewood was another source of energy in their households;
 - 59.8% of 92 respondents being female who used torches as another source of energy;

- Primary research carried out by Mercy Corps reinforces findings from this survey.
 - “67% of farmers and MSME owners reported using dry cell torches, while only 15% reported using the light on their mobile phone, despite 50% of refugees in Bidibidi owning a phone. A substantial percentage of respondents reported burning grass or just living in darkness at night. No one reported using paraffin nor was it sold in any of the markets.”³³

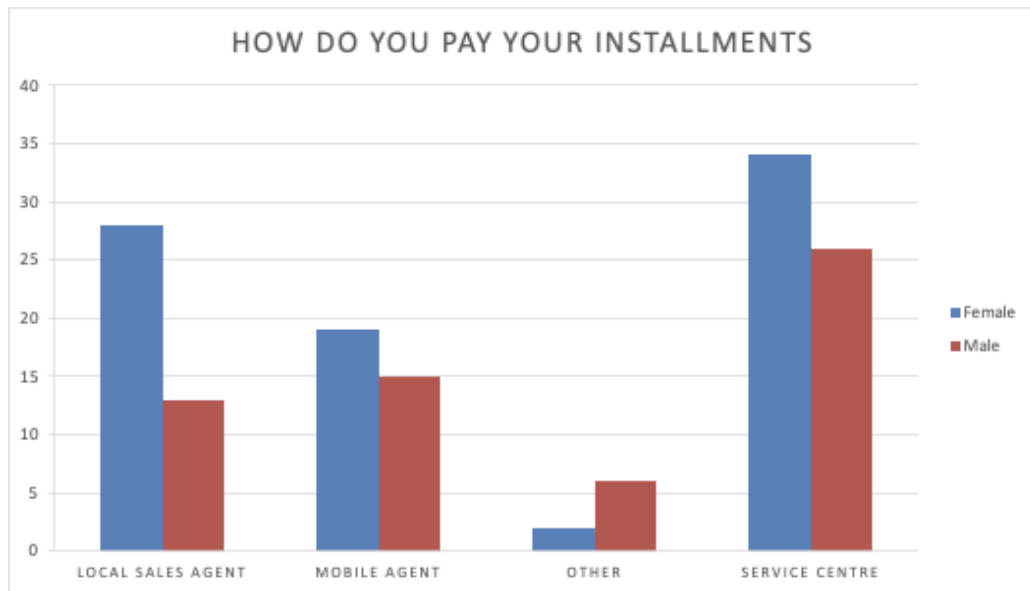


Chart 3: Payment for PAYGO Installments

Chart 3: The survey participants were asked to identify the method of payment they used to pay for their installments. A majority of the respondents stated that they used service centers to pay an agent either from Village Power or d.light. The second most common response was local sales agents that collect the installments door-to-door. Mobile agents and payment methods was third in this category.

Therefore, the AMPERE pilot relied heavily on door-to-door sales agents or service centers around the settlement. There was comparatively low use of mobile money used in the pilot. This is clearly something that should be improved for future PAYGO pilots in humanitarian settings, especially considering the COVID-19 crisis where we go towards a more contactless future.

³³ PAYING FOR DARKNESS Strengthening Solar Markets for Refugees in Uganda. Mercy Corps., Nov. 2019, www.mercycorps.org/sites/default/files/2020-01/Paying_for_Darkness_Uganda_FINAL.pdf; Johnson, Oliver W., Vanessa Gerber, and Cassilde Muhoza. "Gender, culture and energy transitions in rural Africa." *Energy Research & Social Science* 49 (2019): 169-179.



Chart 4: Product Satisfaction

Chart 4: There was a high satisfaction level amongst consumers of the solar products, that used either PAYGO or direct cash to purchase the products. There could be some bias with this data as the data collection was conducted by Mercy Corps. To learn more about the specific products that were available to the refugees, please refer to Appendix 4 and 5.

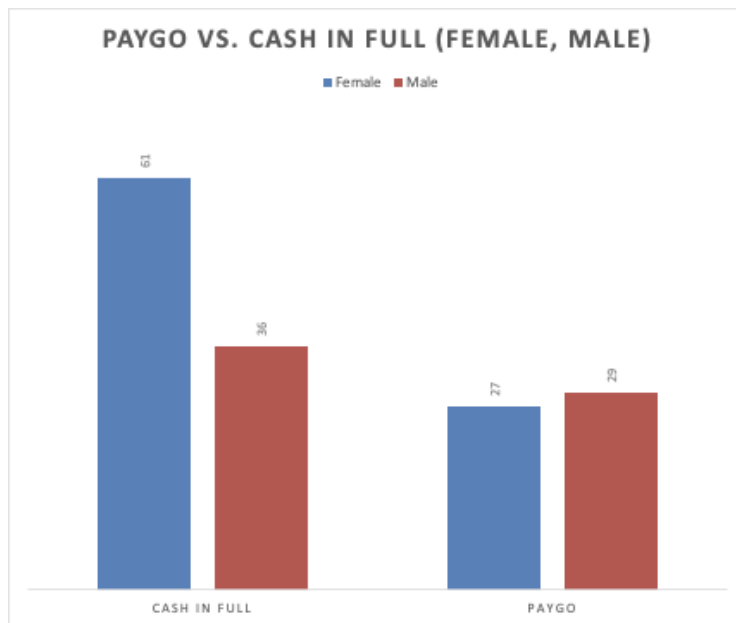


Chart 5: Payment Decisions

Chart 5: Contrary to our hypothesis, the majority of the respondents decided to buy the product fully in cash as opposed to taking advantage of PAYGO. This could also be explained by the fact that out of the 8 products sold only 4 were offered packaged with PAYGO as an option, 1 by d.light and 3 by Village Power. (The 3 products offered by Village Power had the option of being bought with cash, as can be seen in the marketing materials attached in Appendix 6). Furthermore, more women decided to pay cash in full, whereas more men decided to purchase solar products using PAYGO. As shown in the table below, there is a decreasing number of

women purchasing with an increase of the product’s maximum output power and price. The predilection for smaller and cash only products amongst women is also confirmed by their higher representation, 58% in the buying pool for d.light products.

SEX	D-Light	VILLAGE POWER	A2	S3	S30	S500	D150	T200	VP1	VP3	VP6
FEMALE	58%	38%	63%	57%	58%	38%	28%	43%	38%	20%	20%
MALE	42%	62%	37%	43%	42%	62%	72%	57%	62%	80%	80%
TOTAL	1	1	1	1	1	1	1	1	1	1	1

Table 3: Gender Disaggregated Sales Data

Another important factor in low PAYGO participation is the mobile phone accessibility in Bidibidi, especially for women.

There is not enough information on why the participants decided to do this, especially in regards to the purchasing differences amongst men and women. However, we could infer that our initial assessment was not accurate; refugees, particularly 53% of the female population, in Bidibidi are capable of buying solar products without the PAYGO system. Nonetheless, it is important to consider whether the subsidy provided by Mercy Corps played a factor in making the products cheaper, and thus more accessible for refugees for direct purchase. This supports the idea that direct subsidies, facilitated by aid agencies and government donors, can be the solution to make solar products more affordable and easily accessible for refugees.

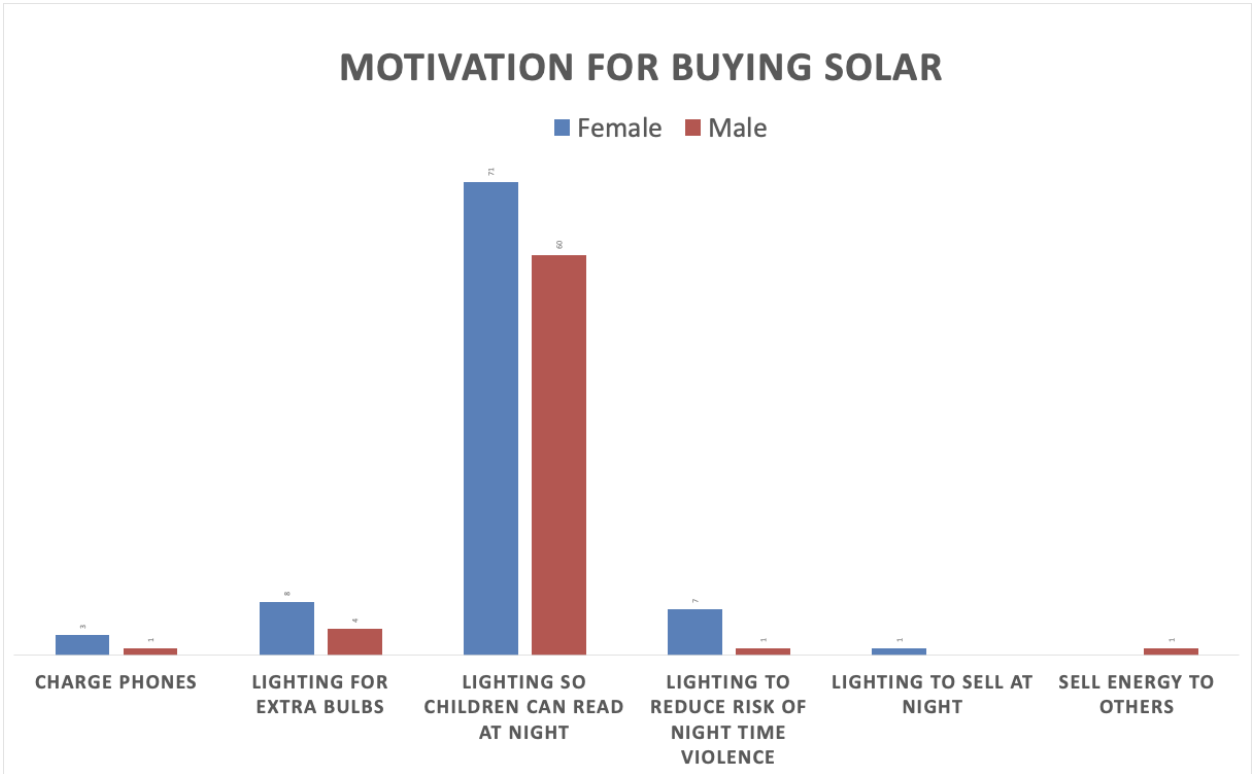


Chart 6: Motivations for Buying Solar

Chart 6: The largest motivation for purchasing solar products, for both men and women, was to increase “lighting so children can read at night.” After that, both men and women stated that they used the products for extra light bulbs. Therefore, according to the survey, it can be stated that the demand for solar products is primarily to increase lighting in households.

There was a distinguishable difference between men and women when it came to purchasing solar products to have “lighting to reduce risk of night time violence”. For respondents who identified this as a motivation, almost 90% were women and only 10% men. This aligns with our literature review that discovered that many women are vulnerable to violence in the refugee settlement. Additionally, as significantly more women than men said that they use solar products so that their children can have access to lighting to read at night, it can be deduced that women prioritize the needs of their family more. This information also aligns with our literature review. However, it is important to acknowledge that the results of the survey may be skewed by the fact that more women were interviewed for this survey.

The majority of both male and female respondents (64%) stated that they had the deposit required to commit to the PAYGO program/AMPERE pilot. After that, approximately 30% of respondents stated that they needed to save, and only 6% said they used VSLA to gain readiness for the PAYGO program. According to this data, it can be inferred that most refugees in Bidibidi had the savings to invest in an energy access program, which is a positive indication of market demand in the settlement, however there was a significant subsidy being provided to the participants of the AMPERE, therefore the readiness could be due to the lowered price of products and market activation efforts that preceded the launch of the products, allowing people to save to purchase products that fulfilled their needs.

Alternative Energy Access Mechanisms/Strategies

Community solar

In contrast to the PAYGO model, where an individual purchases a small solar home system and pays off the costs over a contracted period, community solar may be a possible alternative solar financing mechanism. Community solar refers to “local solar facilities shared by multiple community subscribers.”³⁴ In this model, subscribers contribute a portion of needed cost and receive an allocation of the produced energy. However, community solar is a relatively new model and adoption is mostly limited to communities throughout the United States, with some projects developing in the United Kingdom, European Union, and emerging economies such as China and India.³⁵ Research should assess the ability of community solar to meet the energy needs in humanitarian crisis settings.

³⁴ Solar Energy Industry Association (SEIA). “Community Solar” Accessed from: <https://www.seia.org/initiatives/community-solar>

³⁵ Peters, et. al. “Community solar initiatives in the United States of America.” *Energy Policy*, 121. 2018. Accessed from: <https://www.sciencedirect.com/science/article/pii/S0301421518304117?via%3Dihub>

Conclusions and Recommendations

Conclusions

The conclusions that can be drawn from the data available are limited due to discrepancies. However, there are conclusions that we were able to extract that were in accord with our findings from the literature review.

First, sustainable and reliable energy access is not feasible without a subsidy. Through interviews conducted with community leaders by Mercy Corps, it was reported that there was a decrease in the number of people purchasing solar once the discount (subsidy for product providers) was decreased from 60 to 50 percent in Phase 2 of the AMPERE pilot. In additional interviews with d.light and Village Power managers, it was recorded that without a subsidy market expansion would not be possible and if Mercy Corps is not involved in the future a higher than 50 percent subsidy would be needed. Another key question from these interviews, “Should UNHCR successfully create banking accounts and IDs for refugees with the OPM, how will this affect perceptions on credit risk, if at all? Will refugees be able to acquire longer contracts?” revealed that both energy providers thought that refugees are high risk due to their transient lives and tendency to rely upon “handouts”. So, it may be inferred that the perception of risk of investing in building a market in Bidibidi has not lowered in its entirety and would not be eradicated without a subsidy supporting a product’s life.

Although a subsidy would create more opportunities for energy providers to establish a market in a resettlement setting, the lack of national and international policy that address the fact that the lifetime of a refugee camp has been increasing dramatically over the years. Without the option to earn a livelihood, people sequestered in these camps will need to rely upon humanitarian aid agencies for access to basic needs. Therefore, policies and programs that bridge the gap between emergency response and sustainable development are necessary, especially in light of the mass exodus that the world will be facing due to the climate crisis.

Second, PAYGO does not increase energy access unless there is high mobile phone access, especially amongst women. A study conducted by GSMA found that 49% of the respondents in Bidibidi owned mobile phones, and mobile money usage was 44 %³⁶. However, male refugees have a higher rate of phone ownership, 67% than female refugees, 36%.³⁷ Additionally, it was found that women are 37% less likely to use mobile money than men, which is key to accessing PAYGO.³⁸

In interviews with community leaders, there was a key message recorded:

“Most of the community members complain about not being able to make mobile-based payment. This is due to low education and also lack of access to mobile phones and functioning lines. Since most of the refugees had their phone numbers disconnected by the government, making mobile-based payments is really difficult for most people. In addition, there are few mobile money agents in the settlement which also add to the

³⁶ Downer, Matthew. "The digital lives of refugees: How displaced populations use mobile phones and what gets in the way." GSMA. Last modified 2019.

<https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/07/The-Digital-Lives-of-Refugees.pdf>.

³⁷ Downer, Matthew. "Bridging the mobile gender gap for refugees." GSMA. Last modified March 2019.

<https://reliefweb.int/sites/reliefweb.int/files/resources/m4hgendgaprefugeecontexts.pdf>

³⁸ Downer, Matthew. "The digital lives of refugees: How displaced populations use mobile phones and what gets in the way." GSMA. Last modified 2019.

<https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/07/The-Digital-Lives-of-Refugees.pdf>.

problem. Most people would prefer cash-based payments where they could be issued with receipts when payment is made.”

Therefore, unless the accessibility of mobile phones is addressed, financing models, such as PAYGO will continue to exacerbate existing social and gender inequities.

Recommendations

As outlined in the conclusions, there are two major gaps that limit the scalability and sustainability of PAYGO in Bidibidi and other resettlement camps. Therefore, our recommendations are designed to address the gaps uncovered by our analysis which was supported by quantitative and qualitative data provided by Mercy Corps and a thorough literature review.

The first recommendation tackles the reliance of energy access on the provision of a subsidy with a model that connects the contract length to the availability of a subsidy. In this iteration, a public private partnership would be developed where development agencies and the Ugandan Ministry of Disaster Preparedness and Refugees and the Office of the Prime Minister would sustain funding while the energy providers would sustain energy access. This would continue to lower the risk of creating a market in Bidibidi for energy providers, such as d.light and Village Power and keep the prices affordable for refugees. As low mobile access is another barrier to PAYGO, this partnership would include mobile providers who receive funding from the public entities and development agencies. With the COVID-19 pandemic serving as the circumstantial setting to this report, addressing energy and mobile access is even more significant. Therefore, a model that links these two characteristics of sustainable living for refugees is strategic and significant.

The second recommendation confronts the future of energy access in resettlement settings beyond last mile delivery mechanisms. It extends the vision of off grid solar to a model of community-shared mini grids that rely upon financing through members of village savings and loans associations (VSLAs).

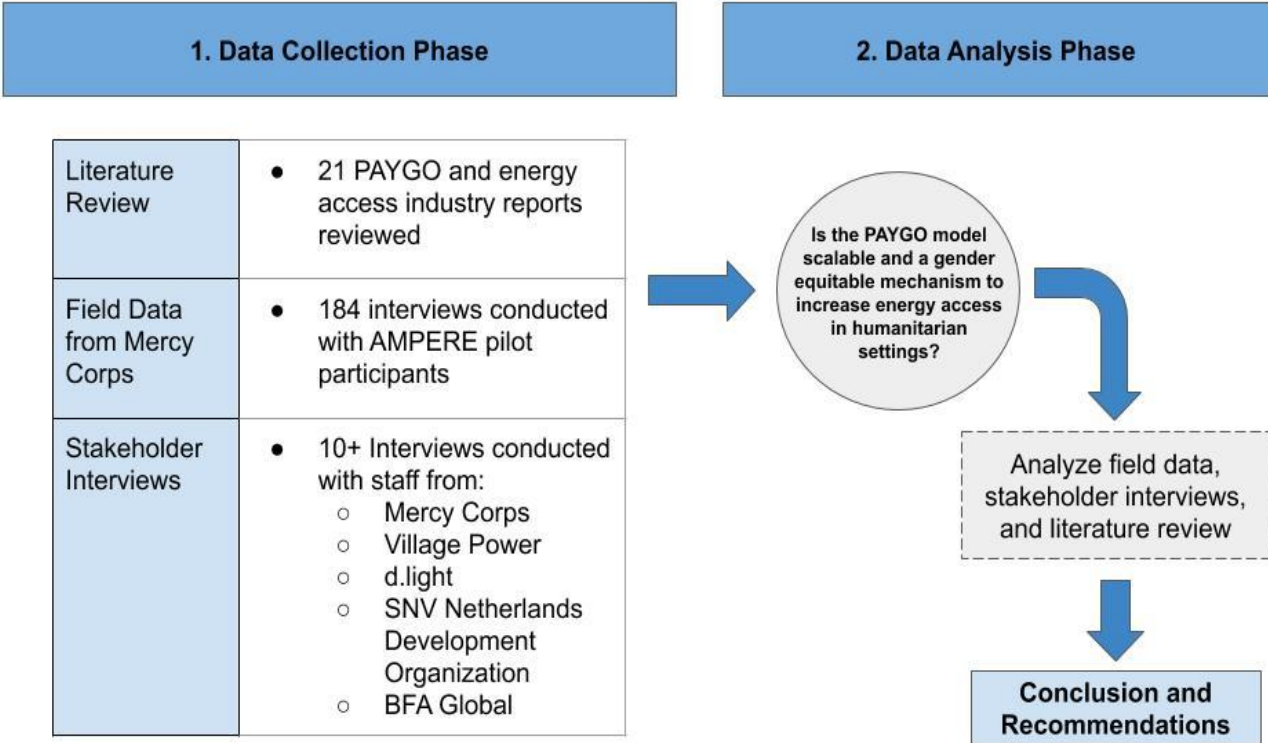
In contrast to the PAYGO model, where an individual purchases a small solar home system and pays off the costs over a contracted period, community solar may be a possible alternative solar financing mechanism. Community solar refers to “local solar facilities shared by multiple community subscribers.” In this model, subscribers contribute a portion of needed cost and receive an allocation of the produced energy. As community solar relies upon a traditional grid for distribution, we recommend utilizing mini grids that rely upon battery storage for distribution. Additionally, utilizing VSLAs not only increases ability to afford monthly energy expenditures, it also opens up a reliable financing option for women to access energy reliably. Therefore, this model addresses the two gaps that were revealed through our analysis: reliance on energy access on subsidies and PAYGO not increasing energy access for women.

This model will require higher fiscal investment to implement and sustain, which might deter governmental agencies, especially ones that do not have pro-refugee policies as constructing a mini-grid and improving energy access will suggest that the resettlement camp is not temporary. Furthermore, concerns of security are high with assets that are integral to mini grids, such as batteries. Therefore, a community governance structure would need to be established prior to the construction of the mini grid. Creating a strong sense of community ownership, while the

management of the physical infrastructure could remain with the energy providers, will be integral to securing the assets and the ability for equitable access.

Appendix

Appendix 1: EmPower Bidibidi's Methodology



Appendix 2: Research objectives and sampling methods

Research Objective	Tools	Sampling and Method
<p>Evaluating sustainability of the PAYGO Model in resettlement setting</p> <ul style="list-style-type: none"> ● Is this model feasible without a subsidy? ● Is Bidibidi unique in its success with the PAYGO model thus far? ● Can this model be viable for other refugee settlements? 	<p>Desk Research</p> <p>Survey Instruments</p>	<ul style="list-style-type: none"> ● Literature review of PAYGO assessments and applications ● Literature review of refugee settlements and models of energy access, and financing tools ● Map characteristics of Bidibidi during field visit ● Key informant interviews with energy providers, Mercy Corps, UNHCR, Save the Children, and Office of the Prime Minister ● Focus group discussions and key informant interviews with 30 participants and 20 non-participants in Bidibidi
<p>Framework for inclusion of women as energy leaders</p> <ul style="list-style-type: none"> ● Are women’s energy needs fulfilled by PAYGO financing model? ● Will creating a framework for women as energy leaders increase disparity? ● Do women currently play a role in last mile distribution? If yes, is the role contributing to gender equity? 	<p>Desk Research</p> <p>Survey Instruments</p>	<ul style="list-style-type: none"> ● Literature review of gender equity and energy access frameworks, programs and assessments ● Focus group discussions and key informant interviews with women participants and non-participants, including other segments

Appendix 3: Stakeholder Mapping for survey instruments

Key Contributor	Government of Uganda	Implementation Partners	Industry Experts	Residents of Bidibidi
Location	Yumbe, Kampala	Remote	Remote	Bidibidi, Uganda
Stakeholders	Ministry of Disaster Preparedness and Refugees Minister for the State of Northern Region	UNHCR Village Power d.light Office of the Prime Minister Save the Children	SE4All Lighting Global Easy Solar Solar Sister GSMA BFA Global	Men and Women Business Owners Farmers Vulnerable groups Participants and Non-Participants
Data Points	Monetary support for energy access Strategy for increasing access	Role and work with Mercy Corps Uniqueness of Bidibidi Applicability of PAYGO	Nexus of gender equity and energy access PAYGO application and feasibility assessments	Current energy needs Changes in energy needs with solar access Role of women Willingness to pay

Appendix 4: Description of Solar Products and Solar Companies

Village Power

Village Power is a SHSs provider based in Uganda. Launched in 2014, the goal of the company is to deliver reliable, affordable and accessible modern energy solutions to Sub-Saharan African families and small businesses.

d.light

d.light is a global leader and pioneer in delivering affordable solar-powered solutions designed for the two billion people in the developing world without access to reliable energy. d.light has hubs in Africa, China, South Asia, and the United States. The company has sold over 20 million solar energy products to date in more than 70 countries.

Company	Product	Description	PAYGO / CASH
d.light Products	A2- Everyday Lantern	Solar panel size: 0.3W Max brightness: 30 lm Max runtime: 4 hours Warranty: 1 year	CASH
	S3- Learning Lantern	Solar panel size: 0.3W Max brightness: 40 lm Max runtime: 12 hours Warranty: 2 years	CASH
	S-30 Family Lantern	Solar panel size: 0.3W Max brightness: 60 lm Max runtime: 12 hours Warranty: 2 years	CASH
	S-200 Mobile charging and light	Solar panel size: 2.3W Max brightness: 200 lm Max runtime: 20 hours Warranty: 2 years	CASH
	T-200 Mobile charging solar lantern	Solar panel size: 2.8W Max brightness: 180 lm Max runtime: 8 hours Mobile charging: Yes Warranty: 2 years	CASH
	D150 Solar Home System	1 tube light, 2 bulbs, base unit, panel, mobile charging adapters, torch and FM radio; created specifically for PAYGO customers	PAYGO
Village Power Products	VP1	DC system; 3 bulbs 1W and 1 multiple mobile phone charger	PAYGO
	VP3	DC system; 4 bulbs 1W, 2 bulbs 3W, 1 mobile phone charger	PAYGO
	VP6	AC system; 12 bulbs 3W, 1 mult mobile phone charger	PAYGO

Appendix 5: Images of products sold by d.light and Village Power



Appendix 6: Village Power's marketing materials in Bidibidi

Benefits of Solar

- Save Money with Solar.
- Solar is clean renewable energy and this is good for your health and the environment.

Why Village power?

- All our Products are installed by our professionally trained Technical teams. We also train our customers on how to effectively manage their solar systems to ensure the best experience.
- At Village power, we offer our customers a flexible instalment payment plan for their solar home systems of up to 15 months.
- We offer a 2 year warranty on all our Products. For all issues that cannot be solved over the phone, Village Power will assign a qualified Technician to solve the issue on site.

Village Power Promise

14 days: If you purchase a Village Power solar system and you are not happy with the product, return it for a full refund within 14 days.

Solar Panel Village Power Solar TV Solar Battery Solar Battery Case Solar LED Bulb

Prices are discounted at 60%, thanks to Mercy Corps and Partners.

VP1 (Home Use)
15WP Panel 5AH Battery

Cash Price after discount	Pay Go price after discount (12 Months)	Deposit (includes first 14 days)	Min Daily Payment	Monthly Payment
140,000	239,900	15,000	650	19,500

VP3 (Business)
40WP Panel 20AH Battery

Cash Price after discount	Pay Go price after discount (12 Months)	Deposit (includes first 14 days)	Min Daily Payment	Monthly Payment
253,300	464,200	49,000	1,200	36,000

VP6 (Business)
120WP Panel 100AH Battery

Cash Price after discount	Pay Go price after discount (12 Months)	Deposit (includes first 14 days)	Min Daily Payment	Monthly Payment
1,076,000	1,8165,800	155,000	4,800	144,000

Appendix 7: Survey Instruments developed by EE Practicum team

Segment	Vulnerable Groups	Farmers	Female MSME Owner	Male MSME Owner
Profile	Hosts & Refugees	Hosts & Refugees	Hosts & Refugees	Hosts & Refugees
	Male & Female	Male & Female	Female only	Male only
	Disabled / Caregivers / Elderly			

SURVEY FOR FEMALES, INCLUDING MSME OWNER AND FARMERS

Color code: **women**

SURVEY FOR MALES, INCLUDING MSME OWNER AND FARMERS

1. What best describes your gender?
 - a. Male
 - b. Female
 - c. Prefer not to say
2. What is your age?:
 - a. _____
3. What is your marital status?:
 - a. Single
 - b. Married
 - c. Divorced
 - d. Prefer not to say
4. How many children do you have in your household?
 - a. _____
5. How many people are in your household?
 - a. _____
6. What is your country of origin?
 - a. _____
7. Do you speak English?
 - a. Yes
 - b. No
8. Do you speak Arabic?
 - a. Yes
 - b. No
9. Do you speak Swahili?
 - a. Yes
 - b. No
10. What is the highest level of education have you completed?

- a. No Education
 - b. Primary
 - c. Secondary
 - d. d. Post secondary/Diploma/Post Vocational
 - e. University
 - f. _____
11. Are you the head of the household?
- a. Yes
 - b. No
12. What is the source of your household income?
- a. _____
13. Do you purchase food, clothing, lighting, water, etc.(consumables vs. non-consumables)?
- a. _____
14. Are the crops you grow for your household or do you sell them?
- a. Just for my family
 - b. To sell
 - c. Both
 - d. N/A
15. How long have you lived in Bidibidi?
- a. _____
16. Do you have access to a cell phone?
- a. Yes
 - b. No
17. What are your priority energy needs? Please rank from highest priority to lowest:
- a. More bulbs for more rooms
 - b. Children's education
 - c. Charging my phone
 - d. Night time safety for travel/water collection/ shopping
 - e. Night time safety for self and business facilities
 - f. Access to information and communication for business purposes
 - g. More bulbs for more rooms
 - h. Large power source
 - i. Cooking/ stoves
 - j. Other
 - i. _____
18. What has been your primary means of lighting at home before acquiring solar?
- a. Dry cell torch
 - b. Dry Grass
 - c. Parafiin
 - d. Tadoba (Local Light)
 - e. Kerosene
 - f. Mobile phone light
 - g. No source of light
 - h. Other
19. What form of lighting did you travel with at night before buying the solar?

- a. Dry cell torch
- b. Mobile phone light
- c. Solar lamp
- d. Kerosene
- e. No source of light
- f. Other
 - i. _____

20. When travelling at night now, do you take a form of lighting with you?

- a. Yes
 - i. Solar lamp
 - ii. Oil lantern
 - iii. No source of light
 - iv. Other
 - 1. _____
- b. No

21. What market do you go to?

22. Do you sell or buy at the market?

23. 24. What solar energy product did you purchase/prefer?

- a. a. Solar Home systems
- b. b. Solar Lamps/Lanterns
 - i. **Filter if 24= a,**
 - ii. Why did you purchase the solar home system?
 - iii. Is it expensive? Y/N
 - iv. Is it working?

24. Which Solar Service provider did you purchase the solar home system?

- a. D-light
- b. Village Power

25. Are you a member of a Village Savings and Loans Association?

- a. Yes
- b. No

26. How do you pay for solar energy?

- a. Mobile money
- b. Cash transfer
- c. VSLA
- d. Other _____

27. Are you familiar with the option to pay for solar in installments?

- a. Yes
- b. No

28. If yes, how did you hear about the PAYGO model?

- a. PAYGO Energy Provider
- b. d.light sales agent
- c. Village Power sales agent
- d. Neighbor
- e. Village Savings and Loans Associations
- f. Other

29. How often do you make payments?
- a. Daily
 - b. Monthly
 - c. Weekly
 - d. Other _____
30. Have you been able to make all the payments?
- a. Yes
 - b. No
31. What support do you get from your sales agents?
- a. Managing payments
 - b. Repair and maintenance
 - c. Other
 - d. _____ -
32. Do you receive technical assistance from the solar energy system provider? (Y/N)
- a. Yes
 - b. No
33. If yes, how do you receive technical assistance from the solar energy system provider?
- a. _____
34. If not, why not?
- a. _____
35. Are you satisfied with your service? Rate 1-5 (5 being highest)
- a. 1-5
36. Are there any other energy-related issues that you face?
- a. _____